We claim:

1.      A polymer solution for the efficient separation of charged macromolecules by electrophoresis comprising a plurality of polymers, wherein said polymers are different, do not

5      phase separate when dissolved in solution and are entangled to form an interpenetrating network.

2.      A polymer solution in accordance with Claim 1, wherein said polymers are neutral and water-soluble.

3.      A polymer solution in accordance with Claim 1, wherein at least one of said polymers is polyacrylamide ("PAM"), N-substituted PAM, N,N-disubstituted PAM, modified

10      polysaccharides, polyethylene oxide ("PEO"), polyvinylpyrrolidone ("PVP"), polyvinylalcohol PVA, polyethylene glycol ("PEG"), or a random, a graft or a block copolymer based on the backbone monomer segments thereof, wherein nitrogen substitutes are selected from the group consisting of $C_1$ to $C_3$ alkyl, hydroxyl-substituted $C_1$ to $C_3$ alkyl, and methoxy-substituted $C_1$ to $C_3$ alkyl.

15      4.      A polymer solution in accordance with Claim 3, wherein said random, graft or block copolymer is EPE-type Pluronics, N,N-diethylacrylamide ("P(DMA/DEA)"), a copolymer of poly(N-isopropylacrylamide) densely grafted with short poly(ethylene oxide) ("PNIPAM-g-PEO") or polyacrylamide-co-allyl-β-D-glucopyranoside ("P(AM/AG)").
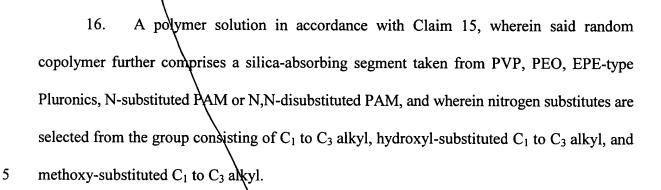
5.    A polymer solution in accordance with Claim 3, wherein said polysaccharides are selected from the group consisting of liquified agrose, methylcellulose ("MC"), hydroxyethylcellulose ("HEC"), hydroxypropyl-methyl-cellulose ("HPMC"), hydroxypropylcellulose ("HPC"), glucomannan, galactonmannan and dextran.

5    6.    A polymer solution in accordance with Claim 1, wherein at least one of said polymers is a silica-absorbing polymer that suppresses electrophoendoosmotic flow and charged macromolecule-silica interactions.

7.    A polymer solution in accordance with Claim 6, wherein said silica-absorbing polymer is selected from the group consisting of PVP, PEO, EPE-type Pluronics, N-substituted

10    PAM and N,N-disubstituted PAM, and wherein nitrogen substitutes are selected from the group consisting of $C_1$ to $C_3$ alkyl, hydroxyl-substituted $C_1$ to $C_3$ alkyl, and methoxy-substituted $C_1$ to $C_3$ alkyl.

8.    A polymer solution in accordance with Claim 1, wherein said interpenetrating network has a more expanded structural formation than the entanglement structure of a

15    corresponding homopolymer solution, and has a larger effective size than that of a corresponding homopolymer solution, representing an effective entanglement network greater than that of the corresponding homopolymers, and wherein said interpenetrating network has a lower molecular weight per volume than the corresponding homopolymers.

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9.	A polymer solution in accordance with Claim 1, wherein said interpenetrating network is prepared by synthesizing a first polymer in a matrix of a second polymer solution.

10.	A polymer solution in accordance with Claim 1, wherein said polymer solution provides at least a 500-base read length in one run for a single-stranded DNA separation.

5	11.	A polymer solution for the efficient separation of charged molecules by electrophoresis comprising a plurality of stretched polymer chains having polymer chain entanglement times greater than the corresponding linear homopolymer solution, wherein said polymer chains comprise the same polymer or a plurality of different polymers.

12.	A polymer solution in accordance with Claim 11 wherein said polymer chains 10 entangle to form an interpenetrating network in solution.

13.	A polymer solution in accordance with Claim 11, wherein said polymers are PAM and PVP or PDAM and PVP.

14.	A polymer solution in accordance with Claim 11, wherein said polymer chains comprise a random copolymer.

15	15.	A polymer solution in accordance with Claim 14, wherein said random copolymer comprises a monomer taken from PAM, N-substituted PAM, N,N-disubstituted PAM, modified polysaccharides, PEO, PVP, PVA or PEG.

16. A polymer solution in accordance with Claim 15, wherein said random copolymer further comprises a silica-absorbing segment taken from PVP, PEO, EPE-type Pluronics, N-substituted PAM or N,N-disubstituted PAM, and wherein nitrogen substitutes are selected from the group consisting of $C_1$ to $C_3$ alkyl, hydroxyl-substituted $C_1$ to $C_3$ alkyl, and methoxy-substituted $C_1$ to $C_3$ alkyl.

17. A polymer solution in accordance with Claim 14, wherein said random copolymer comprises acrylamide ("AM") and dimethyl acrylamide ("DMA").

18. A polymer solution in accordance with Claim 11, wherein said polymer chains comprise a graft copolymer.

19. A polymer solution in accordance with Claim 18, wherein said graft copolymer comprises a monomer taken from PAM, N-substituted PAM, N,N-disubstituted PAM, modified polysaccharides, PEO, PVP, PVA or PEG.

20. A polymer solution in accordance with Claim 19, wherein said graft copolymer further comprises a silica-absorbing segment taken from PVP, PEO, EPE-type Pluronics, N-substituted PAM or N,N-disubstituted PAM, and wherein nitrogen substitutes are selected from the group consisting of $C_1$ to $C_3$ alkyl, hydroxyl-substituted $C_1$ to $C_3$ alkyl, and methoxy-substituted $C_1$ to $C_3$ alkyl.

21.    A polymer solution in accordance with Claim 18, wherein said graft copolymer comprises PNIPAM-g-PEO.

22.    A polymer solution in accordance with Claim 14, wherein said polymer chains comprise a very weakly cross-linked microgel.

5        23.    A polymer solution in accordance with Claim 22, wherein said very weakly cross-linked microgel comprises a monomer taken from PAM, N-substituted PAM, N,N-disubstituted PAM, modified polysaccharides, PEO, PVP, PVA or PEG.

24.    A polymer solution in accordance with Claim 23, wherein said very weakly cross-linked microgel further comprises a silica-absorbing segment taken from PVP, PEO, EPE-

10      type Pluronics, N-substituted PAM or N,N-disubstituted PAM, and wherein nitrogen substitutes are selected from the group consisting of $C_1$ to $C_3$ alkyl, hydroxyl-substituted $C_1$ to $C_3$ alkyl, and methoxy-substituted $C_1$ to $C_3$ alkyl.

25.    A polymer solution in accordance with Claim 22, wherein said very weakly cross-linked microgel comprises PAM and a hydrophilic cross-linker.

15      26.    A polymer solution in accordance with Claim 25, wherein said hydrophilic cross-linker is PEO diacrylate.

27.    A polymer solution in accordance with Claim 11, wherein said polymer solution provides at least a 500-base read length in one run for a single-stranded DNA separation.

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